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Title: **MOISTURE CONVERSION RATIOS FOR THE FOODSTUFFS AND BIOTA ENVIRONMENTAL SURVEILLANCE PROGRAMS AT LOS ALAMOS NATIONAL LABORATORY (Revision 1)**

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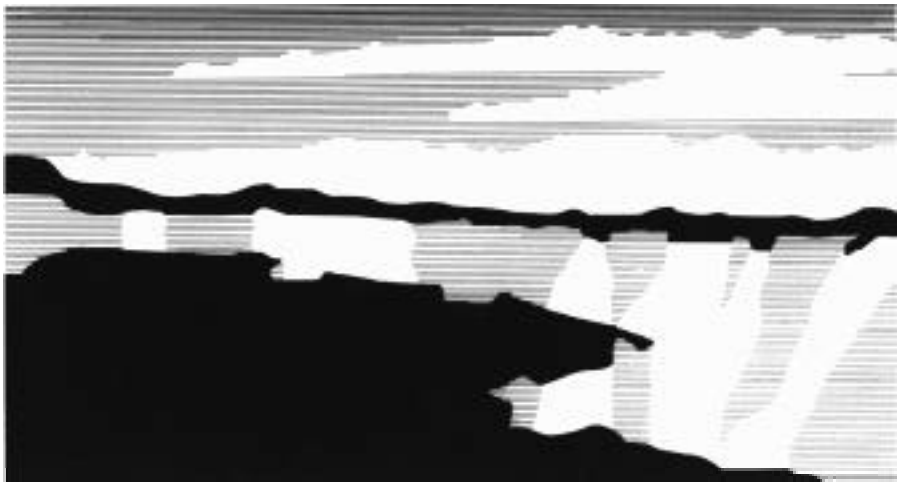

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MOISTURE CONVERSION RATIOS FOR THE FOODSTUFFS AND BIOTA ENVIRONMENTAL SURVEILLANCE PROGRAMS AT LOS ALAMOS NATIONAL LABORATORY (Revision 1)

P.R. Fresquez and J.K. Ferenbaugh

ABSTRACT

This paper reports the mean ash to dry weight and dry to wet weight moisture ratios for a variety of foodstuffs and biota commonly collected as part of the Environmental Surveillance Programs at Los Alamos National Laboratory.

INTRODUCTION

The foodstuffs and biota monitoring programs at Los Alamos National Laboratory (LANL) comprise two of the five Environmental Surveillance Programs mandated by Department of Energy Orders (the others are air, water, and soils), and LANL has conducted these studies since the early 1970s (ESP 1998). Because foodstuffs and biota commonly contain very small amounts of radionuclides in the edible tissue portions, samples are commonly ashed to concentrate the radioisotope(s) in order to adequately detect the element; therefore, results from the analytical laboratory are usually reported in units per gram of ash. To compensate and standardize the differing water contents in various matrices (gram of ash is usually two to four orders of magnitude higher than live weights), units per gram of ash are converted to units per gram of dry material—the standard representation of environmental data. Further, results in units per gram of dry weight are converted to units per gram of wet weight in order to estimate radiation doses to the public from the ingestion of these products (Fresquez et al., 1998a) and risk assessments (Gonzales et al., 1998).

This paper reports the mean ash to dry weight and dry to wet weight ratios for a variety of foodstuffs and biota that have been collected as part of the Environmental Surveillance Programs at LANL and adds more data to a previous report (Fresquez and Ferenbaugh 1998).

METHODS

During the course of processing foodstuffs (fruits, vegetables, grains, fish, elk, deer, domestic livestock, and native foods) and biota (birds, mice, bees, and native vegetation) for (radionuclide) analysis for the Environmental Surveillance Program at LANL, wet,

dry, and ash weights were determined. Moisture weights were determined by (1) placing from 500 to 2000 grams of sample into a tared two liter glass beaker and weighing, (2) placing the beaker plus (wet) sample contents into a drying oven and heating at 70ºC for approximately 120 h, and (3) weighing and placing the beaker plus (dry) sample back into the oven and slowly burning to a final temperature of 500ºC for 120 h. After ashing, the beaker plus sample was allowed to cool for approximately one hour and then weighed. Wet, dry, and ash weights were determined by subtracting the gross wet, dry, and ash weights from the tare weight.

RESULTS

The moisture conversion ratios determined from a host of commonly collected foodstuffs and biota for the Environmental Surveillance Programs at LANL can be found in Table 1.

Table 1. Mean ash/dry weight and dry/wet weight ratios for a variety of foodstuffs and biota commonly collected as part of the Environmental Surveillance Programs at LANL.

Foodstuff/Biota	Ash/Dry	Dry/Wet
Produce (Edible Tissue)[1,2,3]		
Apples	0.036	0.167
Apricots	0.164	0.138
Carrots	0.100	0.089
Cherries	0.098	0.130
Chile	0.073	0.091
Corn	0.064	0.263
Corn (Nonedible Tissue)	0.090	0.150
Crab Apples	0.040	0.250
Cucumbers	0.133	0.049
Green Beans	0.078	0.132
Lettuce	0.250	0.090
Melons	0.118	0.047
Nectarines	0.078	0.159
Peaches	0.076	0.135
Pears	0.031	0.187
Plums	0.123	0.172
Pinto Beans	0.050	0.640
Pinto Beans (Nonedible Tissue)	0.150	0.180
Pumpkins	0.120	0.066
Radish	0.140	0.053
Rhubarb (stalk)	0.078	0.080
Spinach	0.133	0.213

Table 1. (Continued).

Foodstuff/Biota	Ash/Dry	Dry/Wet
Squash	0.131	0.049
Squash (Nonedible Tissue)	0.180	0.080
Tomatoes	0.100	0.074
Herbs[1]		
Parsley	0.110	0.450
Navajo Tea (Cota)	0.066	0.324
Fish (Muscle and Bone)[1,4,5,6]		
Bass	0.120	0.250
Carp	0.116	0.283
Carpsucker	0.071	0.164
Catfish	0.082	0.301
Crappie	0.151	0.236
Pike	0.110	0.250
Sucker	0.126	0.235
Trout	0.077	0.284
Walleye	0.118	0.263
Game Fish (Surface Feeders)	0.121	0.256
Game Fish (Surface Feeders) Vicera	0.128	0.232
Non-Game Fish (Bottom Feeders)	0.095	0.288
Non-Game Fish (Bottom Feeders) Vicera	0.086	0.292
Game Animals[7,8,9]		
Elk Brain	0.068	0.230
Elk (leg) Bone	0.580	0.792
Elk (jaw) Bone	0.622	0.755
Elk Hair	0.027	0.718
Elk Heart	0.031	0.293
Elk Kidney	0.052	0.216
Elk Liver	0.042	0.312
Elk Muscle	0.044	0.255
Deer (leg) Bone	0.440	0.700
Deer Muscle	0.045	0.250
Rock Squirrel Muscle[10]	0.040	0.220
Rock Squirrel Bone[10]	0.340	0.350
Domestic Animals[1]		
Beef Cow Bone	0.500	0.720
Beef Cow Muscle	0.037	0.270

Table 1. (Continued).

Foodstuff/Biota	Ash/Dry	Dry/Wet
Wild Foods (Edible Tissue)[1]		
Acorns	0.030	0.310
Mushrooms	0.084	0.260
Pinon Nuts[11]	0.026	0.898
Wax Currant	0.050	0.190
Wild (Hip) Rose	0.040	0.400
Wild Strawberry	0.060	0.200
Wild Raspberry	0.030	0.210
Wild Rhubarb (stalk + leaf)	0.240	0.090
Native Vegetation[1,12,13,14,15]		
Understory (Grasses and Forbs)	0.100	0.320
Overstory (Shrubs and Trees)	0.050	0.450
Pinon Pine Shoot Tips	0.080	0.420
Birds[16]		
Small birds		
Carcass (muscle + bone + vicera)	0.152	0.306
Pelt	0.038	0.588
Spotted Tohee		
Carcass	0.152	0.292
Pelt	0.034	0.567
Robin		
Carcass	0.142	0.325
Pelt	0.039	0.657
Shrub Jay		
Carcass	0.165	0.311
Pelt	0.042	0.587
Honey Bees[17]	0.032	0.344
Deer Mice (Carcass)[18]	0.160	0.300

[1]ESP (1990-1996), [2]Fresquez et al. (1995), [3]Fresquez et al., (1998a), [4]Fresquez et al. (1994a), [5]Fresquez et al. (1995), [6]Booher et al., (1998), [7]Fresquez et al., (1994b), [8]Fresquez et al., (1996), [9]Fresquez et al., (1998b), [10]ESP (1999), [11]Fresquez et al., (1999), [12]Bennett et al., (1996), [13]Fresquez et al., (1995), [14]Fresquez et al. (1997a), [15]Fresquez et al., (1997b), [16]Keller (1998), [17]Haarmann and Fresquez (1998), [18]Biggs et al., (1999).

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